Review 2.8 Vector Functions
(go with parametric equations)

position vector $\hat{r}(t) = \langle x(t), y(t) \rangle$

velocity vector $\hat{v}(t) = \langle x'(t), y'(t) \rangle$

acceleration $\hat{a}(t) = \langle x''(t), y''(t) \rangle$

start with $\hat{v}(t)$, find $\hat{r}(t)$

$$x(b) = x(a) + \int_a^b x'(t)\,dt$$

$$y(b) = y(a) + \int_a^b y'(t)\,dt$$

final = initial + displacement

FTC

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speed $= \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}$
(not a vector)

total distance $\int_a^b \text{speed}\,dt$

slope of $\hat{v}(t) = \frac{dy}{dx} = \frac{dy/dt}{dx/dt}$

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Ex. A particle moves in the plane with position vector $\hat{r}(t) = \langle x(t), y(t) \rangle$

$x(t) = t^2 - 1$ $\quad y'(t) = \cos(t^2)$

a) Find $\hat{a}(t)$

b) Find speed at $t = 4$

c) Find slope of velocity vector at $t = 4$

d) Find the position of the vector at $t = 4$ if $\hat{r}(0) = \langle -1, 2 \rangle$

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a) $\hat{a}(t) = \langle 2, -2t\sin t^2 \rangle$

b) $\sqrt{(2t)^2 + (\cos t^2)^2}\,\Big|_{t=4} = 8.057$

c) $\frac{dy/dt}{dx/dt} \quad \frac{\cos t^2}{2t}\Big|_{t=4} = -.1197$

d) $x(4) = 4^2 - 1 = 15$

$y(4) = 2 + \int_0^4 \cos(t^2)\,dt = 2.5945$

$y(0) = 2$

$\hat{r}(0) = \langle 15, 2.5945 \rangle$

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